

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 2. REPORT TYPE Technical Papers 3. DATES COVERED (From - To)

4. TITLE AND SUBTITLE 5a. CONTRACT NUMBER 5b. GRANT NUMBER 5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S) Please see attached 5d. PROJECT NUMBER 2302 5e. TASK NUMBER M162 5f. WORK UNIT NUMBER 346120

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048 8. PERFORMING ORGANIZATION REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048 10. SPONSOR/MONITOR'S ACRONYM(S) 11. SPONSOR/MONITOR'S NUMBER(S) Please see attached

12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT 20030129 110

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF: a. REPORT b. ABSTRACT c. THIS PAGE 17. LIMITATION OF ABSTRACT A 18. NUMBER OF PAGES 19a. NAME OF RESPONSIBLE PERSON Leilani Richardson 19b. TELEPHONE NUMBER (include area code) (661) 275-5015

G2

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

14 May 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2001-118**
C.T. Liu, "Monitoring Initiation and Growth of Crack in a Particulate composite Material Using
Nondestructive Testing Techniques"

2001 Society for Experimental Mechanics Conf.
(Portland, OR, 4-6 Jun3 2001) (Deadline 25 May 2001)

(Statement A)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: _____

Signature _____ Date _____

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review.

Comments: _____

Signature _____ Date _____

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b) appropriateness of references, if applicable; and c.) format and completion of meeting clearance form if required

Comments: _____

Signature _____ Date _____

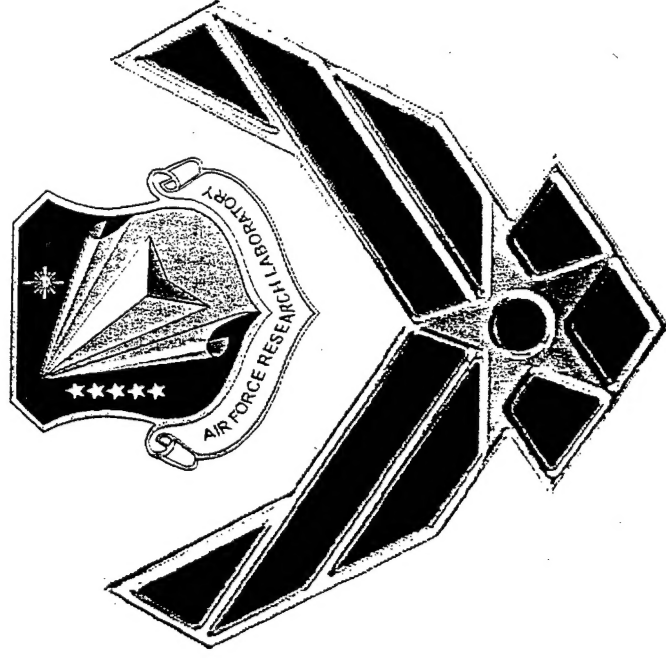
4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: _____

APPROVED/APPROVED AS AMENDED/DISAPPROVED

PHILIP A. KESSEL Date
Technical Advisor
Space and Missile Propulsion Division

MONITORING INITIATION AND GROWTH OF CRACKS IN A PARTICULATE COMPOSITE MATERIAL USING NONDESTRUCTIVE TESTING TECHNIQUES

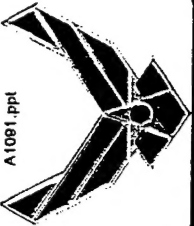


C. T. Liu

AFRL/PRSM

10 E. Saturn Blvd.

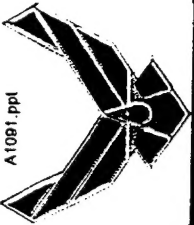
Edwards AFB CA 93524-7680



Objective



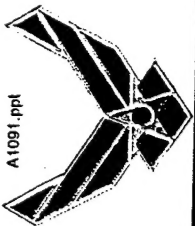
- Investigate Damage Initiation and Evolution and Crack Growth Behavior in a Highly Filled Polymeric Material.



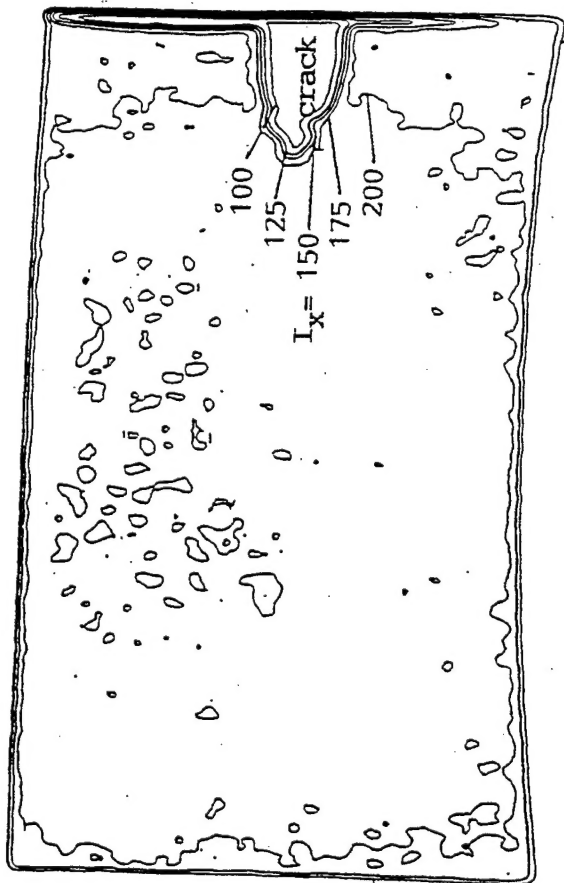
Conclusions



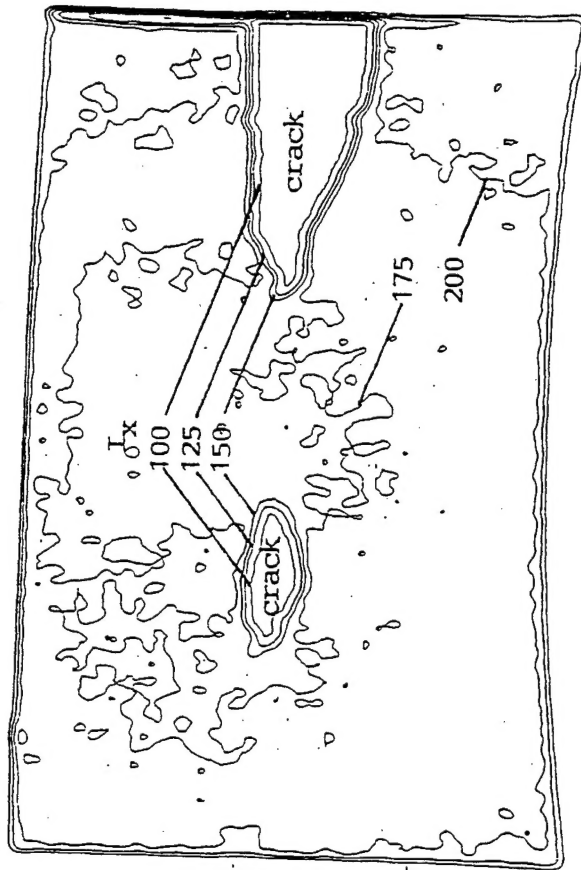
- Real-time x-ray data reveals that damage rate increases rapidly prior to the formation of a crack.
- During the stable crack growth stage, the damage zone size and the intensity of damage increase with increasing time.
- During the unstable crack growth stage, the damage zone size and the intensity of damage decrease with increasing time.
- The results of strain measurement and numerical analysis reveal that the normal strain increases rapidly prior to the formation of a crack.
- The real-time x-ray technique is a promising technique to monitor damage initiation and evolution processes in the particulate composite material.



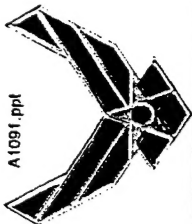
Iso-Intensity Contours of Transmitted X-Ray Energy I_x



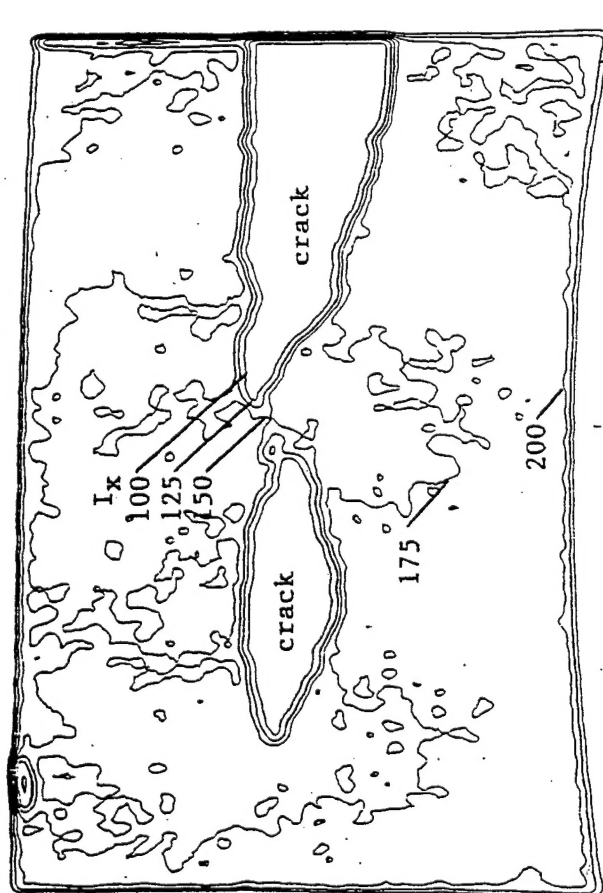
Time: 7:10



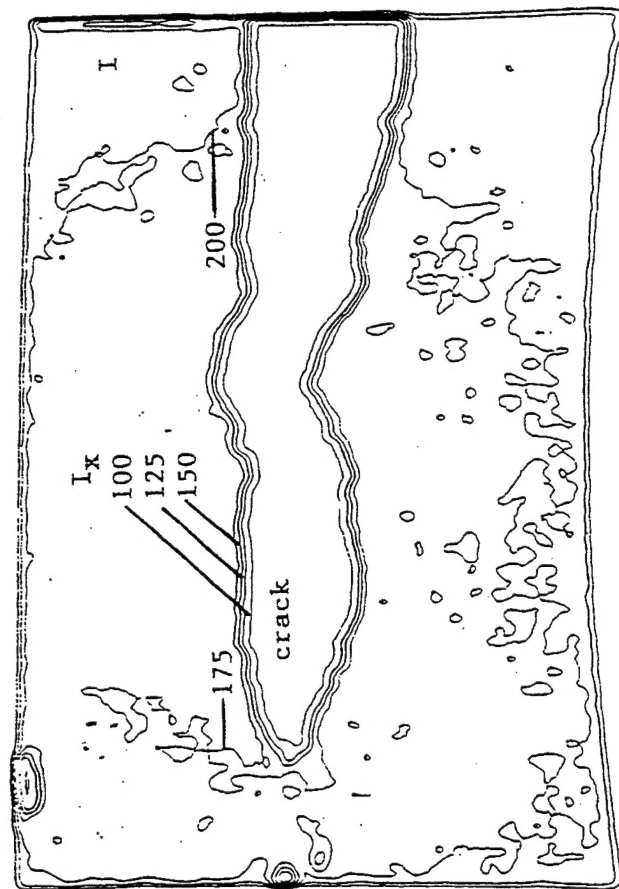
Time: 7:40



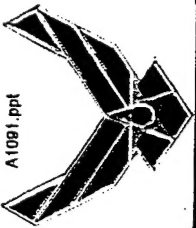
Iso-Intensity Contours of Transmitted X-Ray Energy I_x



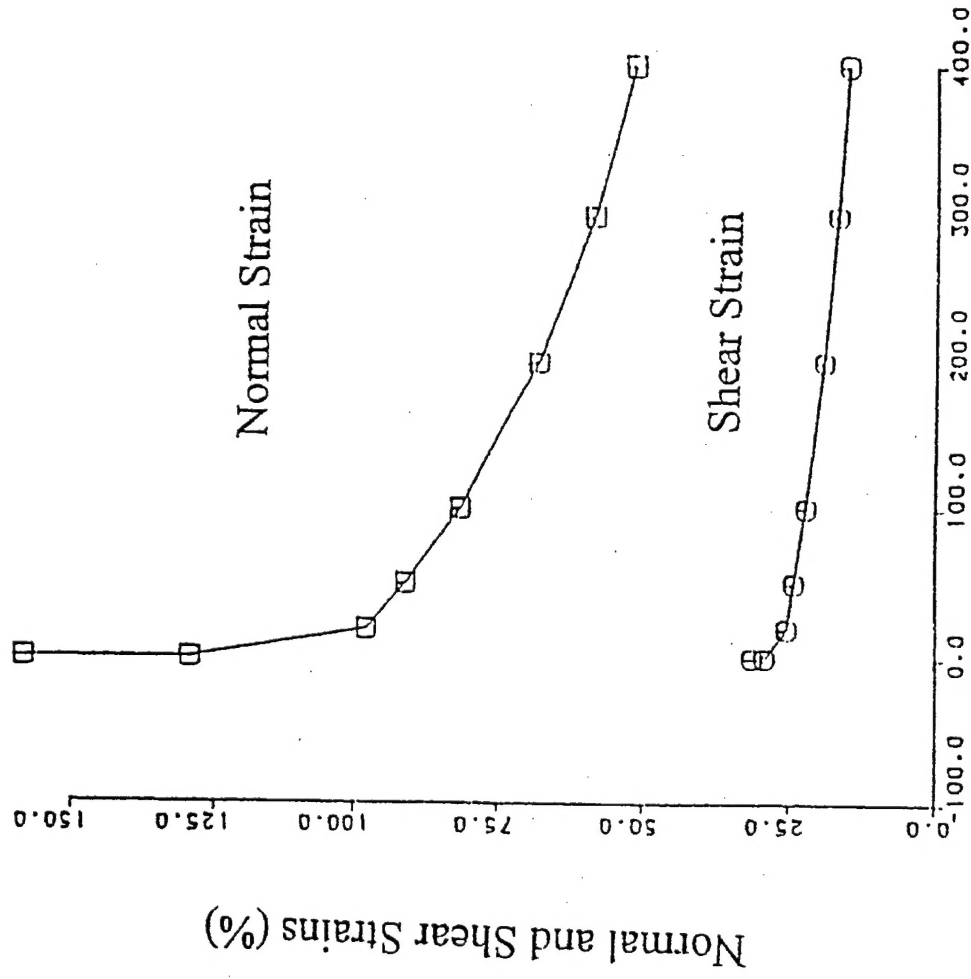
Time: 7:50



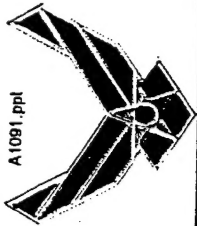
Time: 7:56



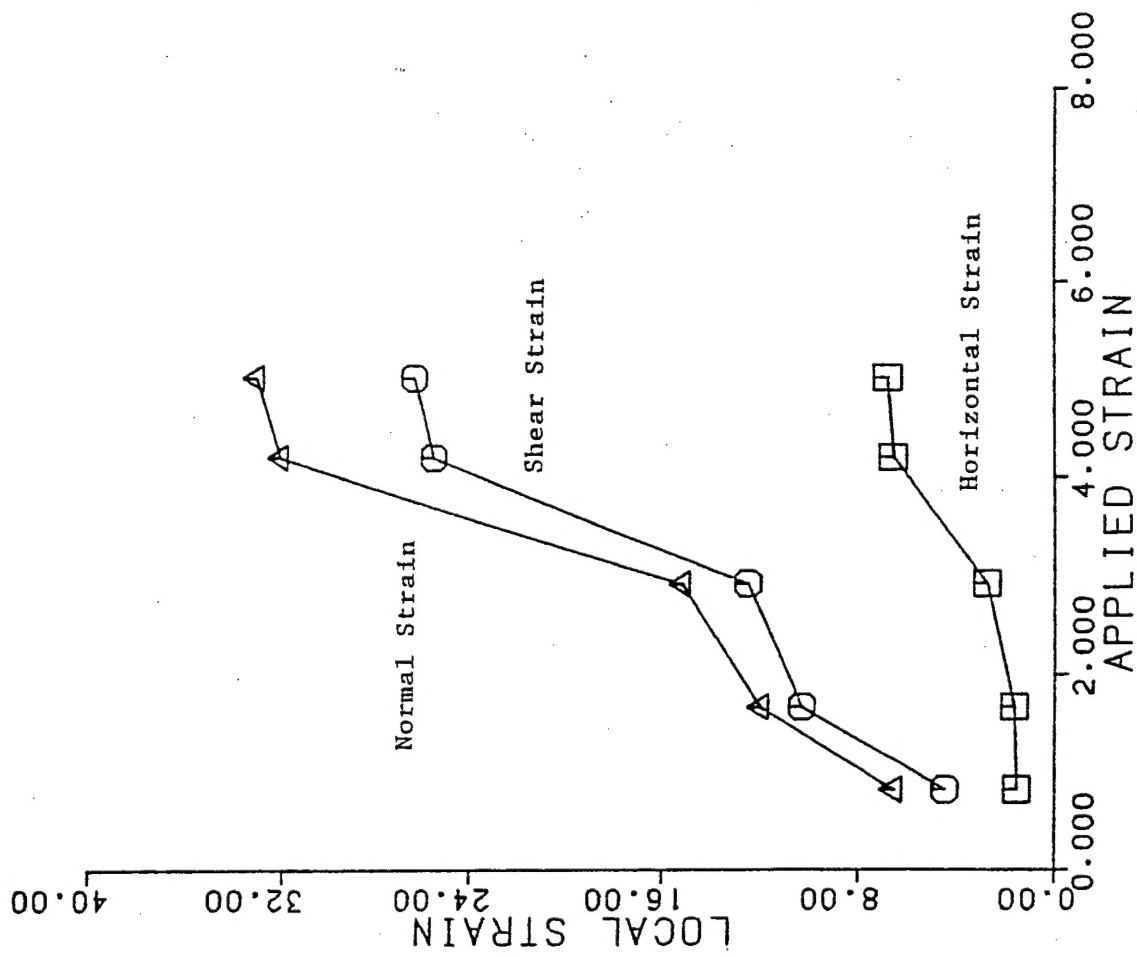
Normal and Shear Strains Versus Young's Modulus

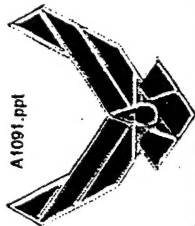


Young's Modulus (145 Mpa)



Local Strain Versus Applied Strain





X-Ray Intensity \bar{I}_x Versus Applied Strain

